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# Impacts of Parks Beach Fires 2004

(Updated 10/1/04)

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# Overview

This report is for information purposes only. In the absence of complete data sets directly germane to the issue of recreational fires in the Puget Sound region, data used for this report often comes from non-uniform sources. Therefore, numeric (including dollar amounts) and narrative conclusions should be viewed as our best estimates and trends. Data and statements in this report are based on interviews with Seattle Parks staff in the first ten months of 2004, air quality and human health data (and information) supplied by the Puget Sound Clean Air Agency, the American Lung Association of Washington, Washington State Dept of Ecology, staff at UW School of Environmental Health, and others. In particular:

# Executive Summary

## Brief History

In 2002, Parks was issued a Notice of Violation (NOV) from the Puget Sound Clean Air Agency (PSCAA) for "allowing" illegal fuels to be burned at Alki Beach. Parks' response to the NOV was to increase 2003 staffing levels at Golden Gardens and Alki beaches during peak times to educate fire recreationists on beach fire rules and regulations. This reduced the amount of illegal fuels burned on our beaches 50% (down to 177 tons annually), and illegal fires by 30%.

## Our (major) Findings

The most germane and pressing way to view the environmental impacts of the public's beach fires is to focus on wood smoke emissions as a localized environmental health issue.

- **Illegal Fuels:** The public's burning of illegal fuels still makes up about 37% of all beach fire emissions (or 177 tons of fuel). This type of emissions is considered highly toxic and should be eliminated (to the best of our ability). The overwhelming majority of illegal fuel burning occurs at Golden Gardens.
- **Illegal Fires:** 37% of all the public's beach fires occur outside established fire rings which is illegal by City code. These fires (which are typically smaller than the ones in designated rings) produce 18% of annual beach fire emissions, most often contain illegal fuels, and represent a safety hazard due to debris and hot coals left behind.
- **Particulate Matter** (or PM, or smoke): At various times of the year, PM is considered a pollution/health concern in our City. Beach fires at Golden Gardens and Alki Beach represent approximate 1% (8 tons) of the total wood fire PM produced annually in Seattle. Members of the Alki Beach and Golden Gardens communities often complain that beach fire smoke impacts them on their property.

## Options For Reducing Environmental Risk and Increasing Compliance

Parks staff identified three options to improve our environmental stewardship and the compliance of our users:

**Option #1**
**Ending public beach fires (except under Special Event permitted status)**

- Eliminates the burning of illegal fuels and illegal fires on the beaches. Results in a 95% reduction of emissions. Eliminates hazardous fire debris hidden in beach sand and allows time for restoration processes (at Golden Gardens mainly). This option required increased enforcement but eliminates the need to clean up after fires. Enforcement would be done by Police with the support of Parks staff.

**Option #2**
**Prohibit fires October 2 – May 30, allow June 1 – October 1 by reservation and fee only**

- Reduces annual beach fire emissions by 30%. Fees partially support a management model ensuring fires are legal. Creates opportunity to educate users before they arrive on the beach. Promotes individual accountability by changing the "culture of use" for beach fires. Eliminates hazardous fire debris hidden in beach sand and allows time for restoration processes (at Golden Gardens mainly). Parks has proposed a fee of $10 for fire permits in the budget generating $11,000 of annual revenue.

**Option #3**
**Allow beach fire recreation to continue "as is" (or status quo)**

- Some improvements to public safety, minimal reductions in annual emissions, and a minimal reduction in illegal fuels and illegal fires will be realized over time if "PM Beach Patrol" efforts continue at existing levels (2003 and 2004). City staff estimate that as much as $95,846 annually in staff time is dedicated to beach fire maintenance. .

Attachment 1

# Current Beach Fire Recreation at Parks, and Regional Air Quality

## Current State of Beach Fires in Seattle

Following a 2002 PSCAA Notice of Violation issued to Parks for "allowing" illegal fuels (rubbish) to be burned on Alki Beach, staff were assigned to "patrol" both beaches during peak fire periods. (No other known citations, notices of violation, or claims have resulted from allowing recreational fires to take place on our beaches.) Through the public education efforts of these beach patrols at Alki and Golden Gardens, overall impacts to our air due to the public's improper use of these beaches and our fire rings have lessened dramatically beginning in the spring of 2003. Through educating and encouraging regulatory compliance with beach fire recreationists in 2003, our beach patrol presence reduced (from assumed 2002 levels) the amount of illegal fuels burned ("bare untreated" firewood being the only "legal fuel"), the number of fires occurring outside established fire rings (defined as illegal by the Park Code), and shortened burn times of many fires as staff extinguished most upon closing of the park. At Alki Beach and Golden Gardens, complaints from park neighbors regarding beach fire smoke declined significantly in 2003 (over 2001 and 2002 levels), and at Golden Gardens, the public has come out in praise and support of our beach patrol efforts. Seattle Parks continued beach patrol staffing in the summer of 2004 to further improve beach fire recreationists' regulatory compliance. Despite the successes of our recent changes in staffing levels at these beaches in the summer; illegal fuels and illegal fires continue to burn in these parks, public safety concerns continue to exist, and citizens in the Alki and Golden Gardens communities continue to express concern over wood smoke in their neighborhoods.

Fire rings are first-come/first-serve, free, and available year-round. The demand for these rings exceeds the capacity in the summer months. During the summer of 2003, legal fuel (firewood) was sold at the bathhouse at Golden Gardens Park.

## Illegal Fuels - Health and Environmental Impacts

Toxic emissions from illegally burned materials such as treated wood and particle board (and other materials such as plastic, construction debris, and garbage) are harmful to humans and should remain our highest beach fire concern. Detailed analysis of the human health and environmental effects of illegal fuels burned in a recreational fire could not be included in the context and scope of this report; however, the recommendation to address the impacts of burning illegal fuels as our highest priority was consistent in the opinion of the people who we consulted on this issue and contributed to and reviewed (in some cases portions) of this report.

## PM (Particulate Mater) - Health and Environmental Impacts

PM ("Soot" or "Smoke") can trigger and/or aggravate existing respiratory ailments such as asthma, can cause damage to normal lung tissue, and increases the chance of infection and illness. Inhaled PM also introduces cancer causing compounds directly into the body. PM is most dangerous for people with existing health problems (lung ailments, heart disease, etc), children, seniors, unborn children, and people most active during high PM episodes. Some statistics show that increased deaths occur in seniors and those suffering from lung or heart ailments when elevated amounts of PM are in our air. Studies have found that more symptoms of respiratory disease in pre-school children are present in high-wood-smoke areas, and increased levels of PM in Seattle are associated with increased asthma symptoms and emergency room visits among children with asthma (at least one in ten children are diagnosed with asthma).

PM is also a major source of haze that reduces visibility, changes soil and water chemistry, and causes erosion/staining of structures (according to the EPA).

**VOCs - Health and Environmental Impacts**

Wood burning also produces Volatile Organic Compounds (VOCs) which, when combined with other pollutants and sunlight, can form ground level ozone ($O_3$) during the summer months in the northwest. Ozone is harmful to humans and our environment when it exists at ground level. Even at very low concentrations, ground-level ozone triggers a variety of health problems including aggravated asthma, reduced lung capacity, and increased susceptibility to respiratory illnesses. Ozone can affect healthy people who are active outdoors when ozone levels are high. Motor vehicle exhaust, industry, and gasoline and solvent vapors are some of the major sources of VOCs, but wood combustion also produces significant amounts of it.

Ground-level ozone also interferes with the ability of plants to produce and store food, and makes them more susceptible to disease and harsh weather.

**Seattle's Air Quality Now**

In general, Washington's air is cleaner than it was 20 years ago as technology and regulation address air pollution (including wood smoke, cut by 50% in that time). However, Seattle remains in the top five percent of cities nationwide with the worst/highest air-toxics (wood smoke contributes to this), and as the Seattle metro area continues to grow, we as a region or city may some day violate the Federal Clean Air Act which would result in increased regulation for our region. Presently, "Good" air quality (an EPA standard, see below) dominates our region on average while most of our air pollution results from choices individuals make daily (driving vehicles more, enjoying fires, etc).

The national measure of the "health concern" (or "quality") of the air is EPA's Air Quality Index (AQI). The PSCAA monitors our region's air (Kitsap, King, Snohomish, and Pierce counties) to insure it does not violate federal air quality standards. If periods of high pollution and/or air stagnation are expected (or exist), and concentrations of certain regulated pollutants, Ozone ($O_3$) and PM are among them, are anticipated to rise from "Good" to "Unhealthy for Sensitive Groups" or to "Unhealthy" for all people (see the table on p.10), the PSCAA will issue a Smog Watch or Burn Ban in hopes of limiting pollution and protecting public health. Smog Watches are only triggered in the summer (when ground level ozone is a major health concern), and Burn Bans are only initiated in the winter (when PM is the leading pollutant of concern).

**Smog Watches and Burn Bans Declared**
**In the Puget Sound Region 1998-2003**

| **Pollution Event** | 2003 | 2002 | 2001 | 2000 | 1999 | 1998 |
|---|---|---|---|---|---|---|
| **Burn Ban** days | 2 | 12 | 5 | 11 | 3 | 0 |
| **Smog Watch** days | 4 | 0 | 2 | 3 | 3 | 0 |

# Beach Fire Inventory, Emission Inventory

## Beach Fire Inventory

Beach fires are allowed by Washington State law as a means of "pleasure," "cooking," and/or "ceremony." A legal beach fire (defined as a "recreational fire" under WAC 173-425), is one that has a fuel pile three feet wide and two feet high or smaller, and the fuel is natural firewood ("bare untreated wood."). A legal recreational fire in a City of Seattle park is further defined by SMC 18.12.270 as one which occurs in a "designated stove or fire ring." Alki Beach has six designated fire rings (up from four in 2002), and Golden Gardens has 12 (up from 6 in 2002). These rings are metal and built to the legal maximum dimension of a recreational fire.

Fire rings at both beaches are sparsely used except in "summer" (June – Oct) when they are used over capacity most of the time. On any given summer day and night, approximately three percent of park visitors at Alki, and 20% at Golden Gardens, attend the beach fires. In January of 2004 at the request of the Environmental Stewardship Unit, maintenance and "beach patrol" staff estimated the frequency of beach fires and type, legal or illegal, and fuel type (legal or illegal) for 2003. Additionally, Seattle Parks staff determined through test burns that on average, a legal fire on our beaches consumes 184 pounds of firewood over five to six hours, and illegal fires consume 62 pounds over one to two hours.

**Beach Fire Emission Inventory**

| **Beach Fire Emissions Annually** Estimated for 2003 | **Total Fires** (of which were illegal) | **Tons Wood/Fuel Burned** (of which were in illegal fires) | **Tons PM Produced** (of which were from illegal fires) | **Tons VOCs Produced** (of which were from illegal fires) |
|---|---|---|---|---|
| **Golden Gardens** (12 rings) | 5,146 (2,386) | 327.9 (74) | 5.5 (1.2) | 37.5 (8.5) |
| **Alki Beach** (6 rings) | 1,732 (416) | 134 (12.9) | 2.2 (.2) | 15.3 (1.5) |
| Other * | 671 | 17.8 | .3 | 2 |
| **Total**** | **7549** (2802) | **479.7** (86.9) | **8** (1.4) | **54.8** (10) |
| % from illegal fires | 37% | 18% | 18% | 18% |

**Includes about 30 other Parks sites, including Christmas Ship fires.*
***Pollutants based on legal fuel emissions. Approximately one third of fuels are illegal…so actual emissions will vary.*

## Illegal Fuels Inventory

"Bare untreated firewood," often described as "clean, seasoned, dry firewood," is the only acceptable fuel source for a legal beach fire (WAC 173-425, and subsequent PSCAA and other agency decisions). Of the illegal fuels burned at Golden Gardens in 2003, staff estimates 70% were from wooden pallets and construction debris, 20% from yard waste, and 10% cardboard and paper. These materials emit toxic compounds that can be a threat to human health and can cause environmental damage. This type of emission and the subsequent health risks are difficult to qualify in the context and scope of this report, but reducing the burning of illegal fuels should continue to be the top priority for Parks. Although new efforts such as beach patrol staffing and added signage have improved the public's compliance with beach fire regulations and laws,

many park visitors continue to burn illegal fuels and fires at Golden Gardens, and to a lesser extent at Alki.

Fewer illegal fuels and illegal fires burn at Alki beach as staff there have the capacity and opportunity to respond adequately to known burning of illegal fuels (and illegal fires), but the geography and intense use at Golden Gardens make it difficult for staff to respond to all illegal burning issues.

In 2003, when beach patrol staffing was added to Golden Gardens and Alki Beach, the public's burning of illegal fuels on our beaches dropped by approximately 50% from assumed 2002 levels, but illegally burned fuels still make up about 37% (177 tons) of total fuels burned at Alki and Golden Gardens. Of the 177 tons of illegal fuels burned, 94% (166 tons) of those fuels were burned at Golden Gardens.

**Percent of Illegal Fuels Burned on the Beach**

| Site-Fuel Type Burned-In Fire Type | Pre-2003 | 2003 |
|---|---|---|
| Golden Gardens | | |
| Illegal Fuels in Legal Fires | 80% | 45% |
| Illegal Fuels in Illegal Fires | 85% | 70% |
| **Golden Gardens Illegal Fuels (all fires)** | **84%*** | **51%** |
| Alki Beach | | |
| Illegal Fuels in Legal Fires | 70% | 5% |
| Illegal Fuels in Illegal Fires | 70% | 35% |
| **Alki Beach Illegal Fuels (all fires)** | **70%*** | **8%** |

***** Estimated, based on the information presented in this table only.

**Illegal Fire Inventory**

Many more illegal fires (those occurring outside a designate ring) occur at Golden Gardens than at Alki Beach, as park use and the geography there makes them more likely. 37% of all fires in 2003 were illegal. These illegal fires accounted for 18% (or 87 tons) of fuel burned on the beaches that year. 85% of the 2802 illegal fires that burned on our beaches in 2003 occurred at Golden Gardens (legal fires at both beaches totaled 6878).

Significant public safety (and to some extent, staff safety) issues can result from illegal fuels and illegal fires burned on our beaches. Nails, brackets, broken glass, and other sharp objects from illegally burned fuels can often be found in beach sand and can pose a threat to unaware beach recreationists. Hot sand, coals, and other hot debris left on the beach or buried in sand can also be dangerous to park visitors (and staff).

**Regional PM**

Although our region as a whole continues to be in compliance with federal standards regarding PM, the PSCAA 2002 Air Quality Data Summary (the most recent available) claims that in 2002 (October - December), elevated PM concentration throughout the Puget Sound region demonstrated that air quality issues with regard to fine particles (PM) are a concern (for King, Kitsap, Pierce, and Snohomish Counties).

**Annual (2003) Beach Fires' Contribution to PM and VOCs Concentrations**

| **Area** | Parks beach fire emissions Compared to total wood fire emissions: | | Parks beach fire emissions Compared to **all area sources** (transportation, industry, etc)**:** | |
|---|---|---|---|---|
| | **PM*** | **VOCs*** | **PM** | **VOCs** |
| Puget Sound Region | .19 % | .4 % | .02 % | .03 % |
| King County | .4 % | .8 % | .06 % | .06 % |
| Seattle | .9 % | 1.9 % | .13 % | .14 % |

**Compared to fireplace emissions… as recreational fire data is not compiled by any regional source.*

**Regional Ozone (which beach fire VOC's contribute to)**

Ground level ozone is another regional pollutant of concern. According to the PSCAA 2002 Air Quality Data Summary, the highest ozone levels in the Puget Sound region occur from mid-May to mid-September on the few hot days favorable for photochemical activity. In this region, the hot sunny days favorable for ozone formation typically have light north-to-northwest afternoon winds. The photochemical reactions that produce ozone continue for several hours, and the trapped pollutants are transported downwind. This creates the greatest ozone concentrations between noon and early evening, at locations 10 to 30 miles from the major sources of VOCs (in general, urban areas, including Seattle). Therefore the highest concentrations of ground level ozone (and greatest health risks) in the Puget Sound region are measured in areas such as North Bend, Enumclaw, and Eatonville (see table on p.11).

While ground level ozone pollution levels in Seattle remain "Good" year-round, concentrations of ozone in some of the outlying areas during the summer average in the "Moderate" level, and frequently climb into the "Unhealthy for Sensitive Groups" level, and at times reaches the "Unhealthy" for all people level.

# Local and Regional Effects of Beach Fire PM and Ozone

## PM-Local Effects

Common sense dictates that people living nearest Alki and Golden Gardens beaches are most impacted by beach fire smoke generated at those beaches, but there is little hard evidence to substantiate this because air quality monitoring stations are not located immediately near these parks, changing meteorological conditions affect the dilution and dispersion of the smoke, and data regarding bulk PM in Seattle and outlying areas show it is fairly evenly distributed.

The data and statements that follow use raw air quality data from the two air monitoring stations nearest (and downwind of) Alki and Golden Gardens beaches. The Duwamish Valley station is 3.5 miles away from Alki Beach, while the Queen Anne Station is 4.7 miles away for Golden Gardens. Based on our interviews with a number of professionals in the air quality and environmental health field, accurate measurement of the public's beach fire generated PM (and its local effects) most likely needs to take place within one quarter to one half mile of the beach, but nonetheless, some of the conclusions that follow may be relevant to our interests.

> *(Note: Smog Watches and Burn Bans are called when a weather phenomenon termed an "inversion" occurs or is expected. Inversions prevent the mixing of air from ground level to the more upper layers of the atmosphere thereby "trapping" pollutants along the surface of the earth where air quality can degrade over time and effect human health, wildlife, and plant life.)*

During PSCAA declared region-wide Smog Watches (called to limit the concentration of ground level ozone in the region) and Burn Bans (called to limit the concentration of PM in populated areas) in 2001-2003, which combined covered a total of 25 days, the majority of PM readings (daily averages) at the Duwamish Valley and Queen Anne air stations rose from "Good" to "Moderate," and at limited times "Unhealthy for Sensitive Groups" (at the Duwamish site only). In Seattle, these elevated PM levels remained up to 5 days after a region-wide Smog Watch or Burn Ban had been lifted. Additionally, many days of "Moderate" air quality occurred at times unassociated with a PSCAA Burn Ban or Smog Watch. Based on these statements (and the table that follows), it can be assumed that the PSCAA declared pollution episodes (Smog Watches and Burn Bans) are good indicators of times when "Good" PM concentrations in Seattle can be expected to reach a "Moderate" or "Unhealthy for Sensitive Groups" level, but "Moderate" (rather than "Good") air quality due to elevated PM pollution in Seattle can also be expected to exist at times outside of declared pollution episodes.

## Nuisance Smoke

Despite the efforts of our 2003 Beach patrol staff reducing the amount of illegal fuels and illegal fires burned at Alki Beach (and Golden Gardens), the proximity of homes to Alki beach, and the frequency of smoke complaints telephoned in to Parks during the summer, raise concerns that beach fire emissions (which are overwhelmingly "legal" emissions) may at times be a nuisance to neighbors of Alki Beach.

**"Normal" levels of Daily PM for 2001-2003 in Seattle Compared to Smog Watches and Burn Bans Days**

| **Air Quality 2001-2003** | Smog Watch called for: **6** days | Burn Bans called for: **19** days | **Health Risk** |
|---|---|---|---|
| # Days **Good** | 532 (D)<br>536 (Q) | 391 (D)<br>504 (Q) | Air quality is considered satisfactory, and air pollution poses little or no risk. |
| # Days **Moderate** | **15** (D)<br>**10** (Q) | **156** (D)<br>**43** (Q) | Air quality is acceptable; however, there may be a moderate health concern for a very small number of people. |
| # Days **Unhealthy for Sensitive Groups** | 0 | **3** (D) | Members of sensitive groups may experience health effects. The general public is not likely to be affected. |
| # Days **Unhealthy** | 0 | 0 | Everyone may begin to experience health effects |

*****Based on a daily average of hourly PM measurements from Queen Anne and Duwamish Valley air stations
D= As recorded by the Duwamish Valley Air Quality Station
Q= As recorded by the Queen Anne Air Quality Station
*It is important to note that the Duwamish Valley monitoring station is in an industrial part of Seattle while the Queen Anne station is in an area of residential homes and small businesses, and Burn Bans and Smog Watches are generally intended to prevent pollution levels from entering the "Unhealthy for Sensitive Groups" level and "Unhealthy" for all level, not "Moderate" level.*

**Ozone-Local Effects**

According to the only ozone monitoring site in Seattle (on Beacon Hill), Seattle's ozone concentrations were measured at "Good" every day for the last three years. As the table below suggests, ozone formation in Seattle does not represent a significant pollution problem for our citizens, but beach fire emissions can be assumed to contribute to ozone levels which often reach "Moderate," "Unhealthy for Sensitive Groups," and at limited times "Unhealthy" (for all people) in outlying areas.

Beach Fires at Golden Gardens and Alki Beaches produce approximately .03% of all VOCs in our region.

**2001-2003 Summertime OZONE Levels in Seattle, Issaquah, and the Further Outlying Areas.**

| Area | Aprox Miles from beaches | Days of PSCAA Smog Watches* | Days of 8 hour average Ozone concentrations at the "Moderate" level. | Days of 8 hour average or 1 hour max Ozone concentrations at or in excess of the "Unhealthy for Sensitive Groups" level. |
|---|---|---|---|---|
| Seattle | 0 | 6 | 0 | 0 |
| Issaquah | 20 | 6 | 3 | 0 |
| North Bend, Eatonville, Enumclaw | 32-38 | 6 | 4+ | relatively frequent |

* Same number for all towns as they are in the same region

**Other Significant Impacts**

Illegal fires in the northern part of Golden Gardens beach, combined with the foot traffic they create, cause some degradation of natural habitat and cause some wildlife displacement. This mainly occurs on the beach and back-beach ("dunes") environments adjacent to the Marine Reserve. Birds (and to a lesser extend seals) use this area for rest, food, fresh water, and shelter (at limited times).

Fires do not significantly impact the existing natural habitat value (which is minimal) at Alki Beach.